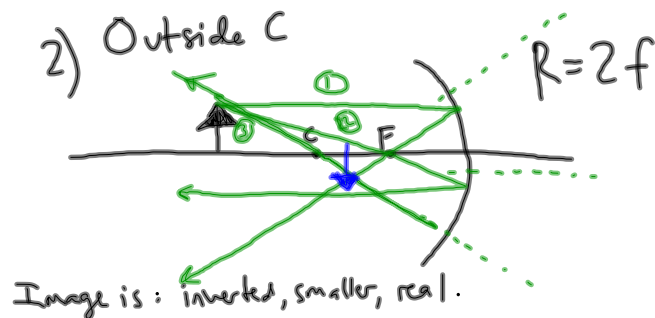


Concave Spherical Mirrors cont'd:

2) Outside C



Draw three rays:

- 1) Parallel to principle axis, through F
- 2) Through F, parallel to principle axis
- 3) through C, back through C to top of the object

Image is formed at intersection point of three rays

Image Characteristics:

Upright or Inverted

Real or Virtual

Larger, smaller, or same size

Equations:

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$M = \frac{-d_i}{d_o} = \frac{h_i}{h_o} \quad M \text{ is magnification}$$

3) On C

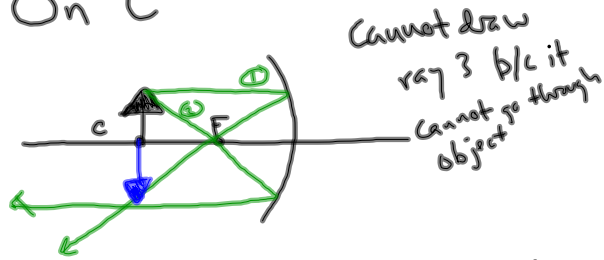


Image Characteristics: Inverted, same size, real

4) Object between C and F

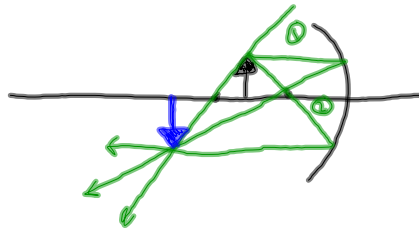
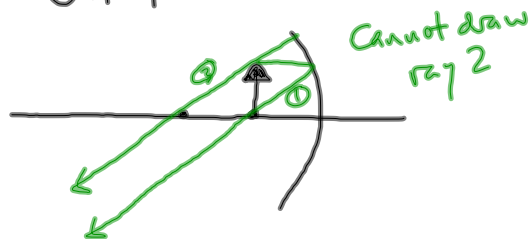


Image: real, inverted, larger

5) On F



6) Inside F

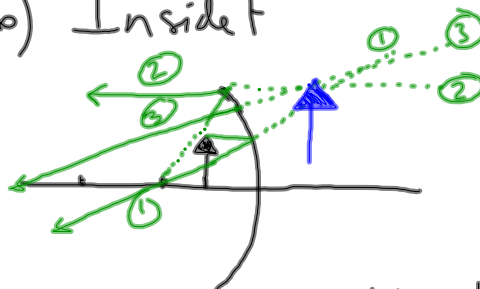


Image: Larger, upright, virtual

Example 1:

An object $h_o = 5 \text{ cm}$ is placed at 30 cm from a concave mirror. The mirror has a focal length of 20 cm. Find the image distance, magnification, and height and create a ray diagram to verify the characteristics.

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

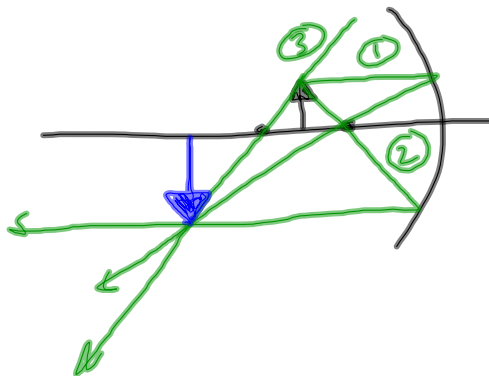
$$d_i = \left[\frac{1}{f} - \frac{1}{d_o} \right]^{-1}$$

$$= 60 \text{ cm}$$

$$M = \frac{-d_i}{d_o} = -2$$

$$M = \frac{h_i}{h_o}$$

$$h_i = M h_o = -10 \text{ cm}$$





M

$> |1|$

$= |1|$

$< |1|$

Size

larger

same size

smaller

M

—

+

Characteristic

inverted, real

upright, virtual

Example 2:

Object 10 cm high placed 100 cm from concave mirror. Mirror has focal length of 25 cm. Find M , d_i , h_i , and characteristics with math and ray diagram.

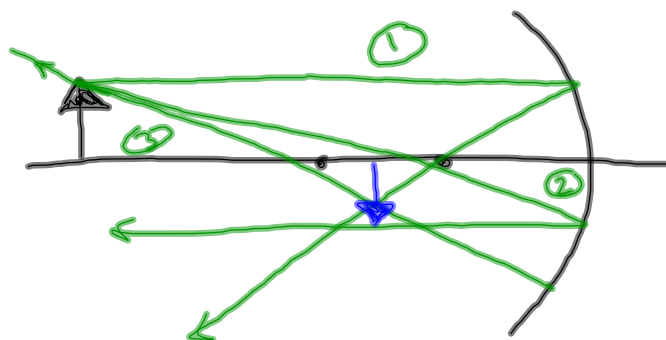
$$h_o = 10 \text{ cm} \quad d_o = 100 \text{ cm} \quad f = 25 \text{ cm}$$

$$d_i = \left[\frac{1}{f} - \frac{1}{d_o} \right]^{-1}$$

$$= 33.3 \text{ cm}$$

$$M = -\frac{d_i}{d_o} = -.333 \text{ cm}$$

$$h_i = M h_o = -3.33 \text{ cm}$$



Example 3:

Object with height of 7 cm is placed at 10 cm. A concave mirror has a focal length of 20 cm. Find M , d_i , h_i and image characteristics.

$$d_i = \left[\frac{1}{f} - \frac{1}{d_o} \right]^{-1}$$

$$= -20 \text{ cm}$$

$$M = \frac{-d_i}{d_o} = 2$$

$$h_i = M h_o = 14 \text{ cm}$$

